Modeling River Meander Migration

Eric W. Larsen Landscape Architecture Program University of California, Davis

# Goals

- review decision support tools and data set and how they relate to the conservation strategy goals
- quantify geomorphic process
- improve geomorphic process

Quantitative methods give us a framework to set a baseline and evaluate how we achieve our goals

## **Background legislation**

#### **2008 Central Valley Flood Protection Act**

- Promote <u>natural dynamic</u> ... <u>geomorphic processes</u>
- Increase and improve the quantity ... of riparian ... habitats

#### **2012 CVFPP Conservation Framework**

Ecosystem processes (<u>natural river process</u> included)

#### **2017 Conservation Strategy**

- Goal: Ecosystem Processes: Improve and enhance <u>natural dynamic</u> ... <u>geomorphic processes</u>.
- Objectives: 1) Increase Inundated Floodplain, 2) Improve Riverine
   Geomorphic processes

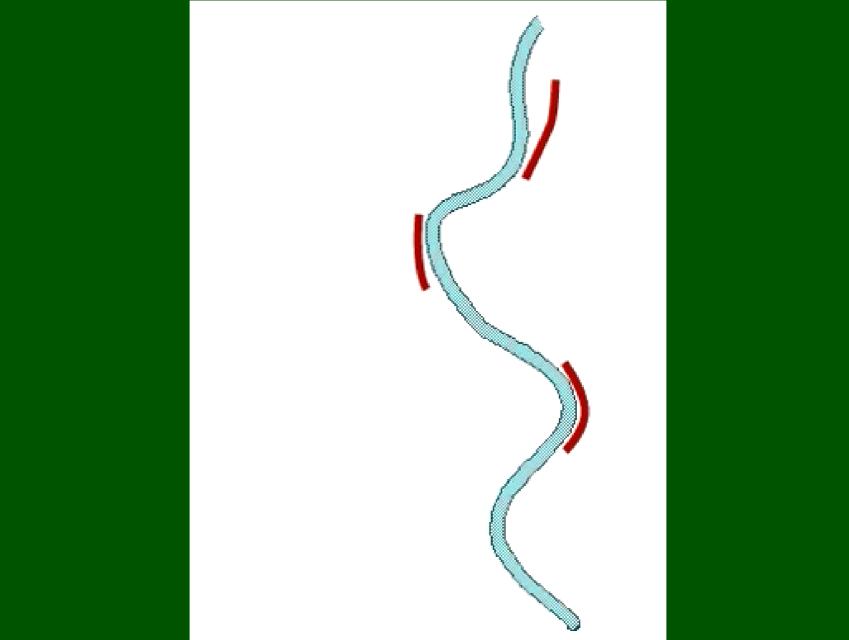


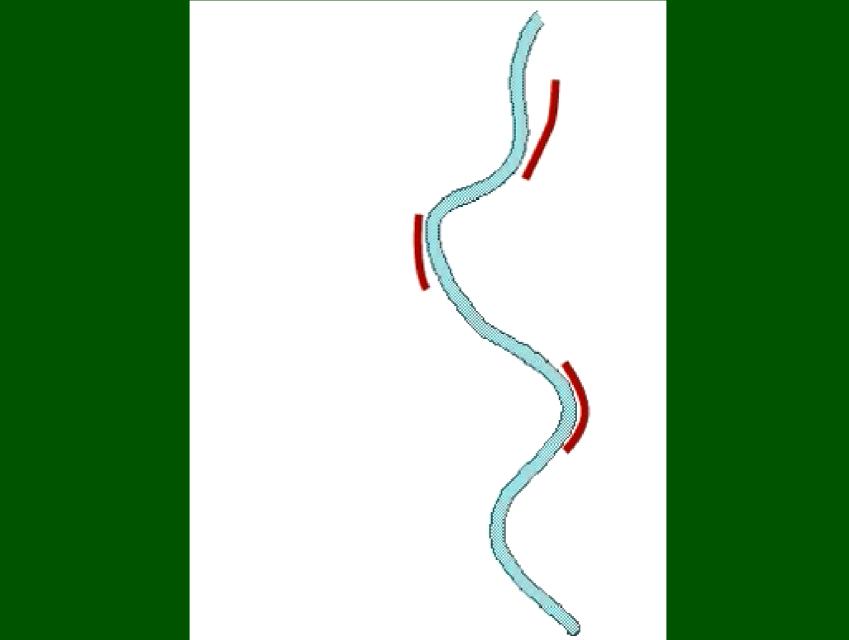
## **Channel migration**

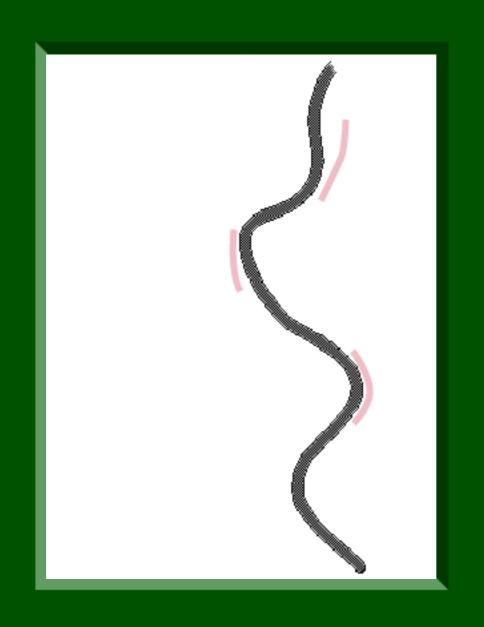
- Establish and maintain riparian habitat
- Establish oxbow lakes
- Support riverbank ecosystems
- Provides Large Woody Material recruitment

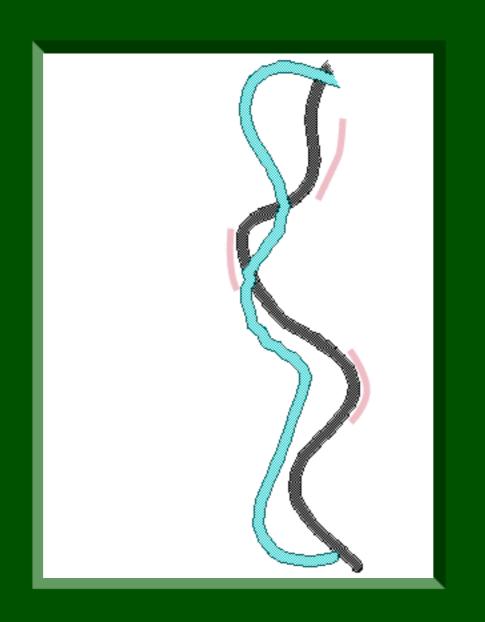
# Benefits riparian forest dynamics

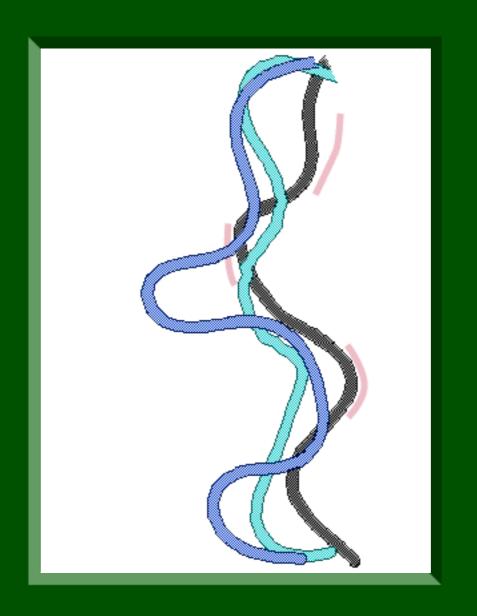
- promotes primary succession
- -increases extent of forest size
- beneficial mix of age classes











# Meander migration occurs naturally (nature <u>always</u> bats last)

If you do not understand how and where migration occurs.....



# Migration model: Input data and calibration

- 1. GIS channel input data (centerlines)
- 2. Hydraulic input data
- 3. Spatially variable erosion field (GIS of geology, vegetation, and hard points

## Hydraulic input data

- Representative Q, S, W, depth, D50
- Used in model calibration and application

## **Metrics**

Sinuosity/channel length

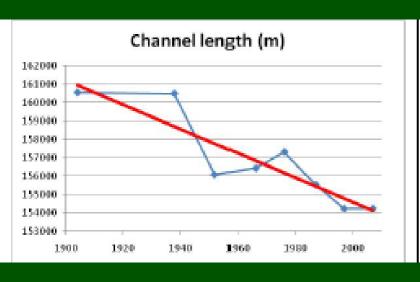
Area reworked

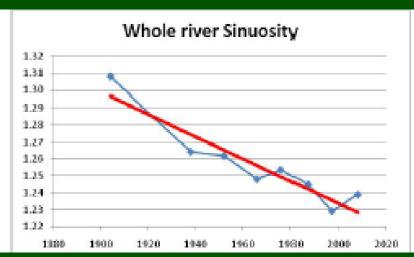
Floodplain age

#### (F) RIVER PLANFORM AND GEOMORPHIC PROCESSES

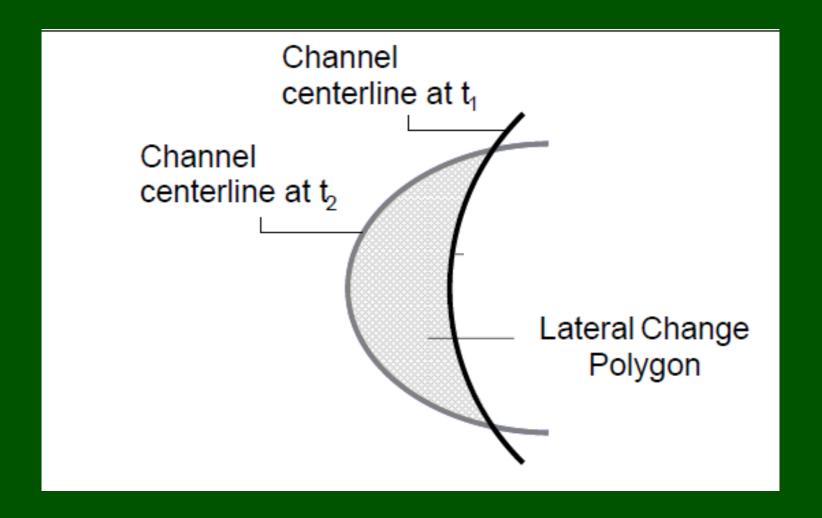
Ecological indicators	Geographic study area	Temporal horizon	Results	Sources	Trend 9
Area of floodplain reworked	Riparian zone between Red Bluff and Colusa	1906 – 2007	Decreased in recent decades	Larsen (unpublished)	-
			Highly variable over long term, although trending downward		(_)
Length of bank with riprap	Mainstem river channel between Red Bluff and Colusa	1936 – 2002	Increased in recent decades	Henderson (unpublished)	-
			Dramatic increase over long term, especially since the 1960s		()
Whole river sinuosity	Mainstem river channel between Red Bluff and Colusa	1906 – 2007	Increased slightly between 1997 and 2007	Larsen (unpublished)	0
			Decreased significantly (by 6% from 1.31) over the period of record		(_)
Total channel length	Mainstem river channel between Red Bluff and Colusa	1906 – 2007	Decreased in recent decades	Larsen (unpublished)	-
			Decreased significantly (by 4%, from 160,529 m) over the period of record		(_)
Average bend entrance angle	Mainstem river channel between Red Bluff and Colusa	1906 – 2007	Decreased since 1987 (to lowest value ever in 2007)	Larsen (unpublished)	-
			Decreased significantly (by 13%, from 46 degrees) over the period of record		(_)

# Length (sinuosity)

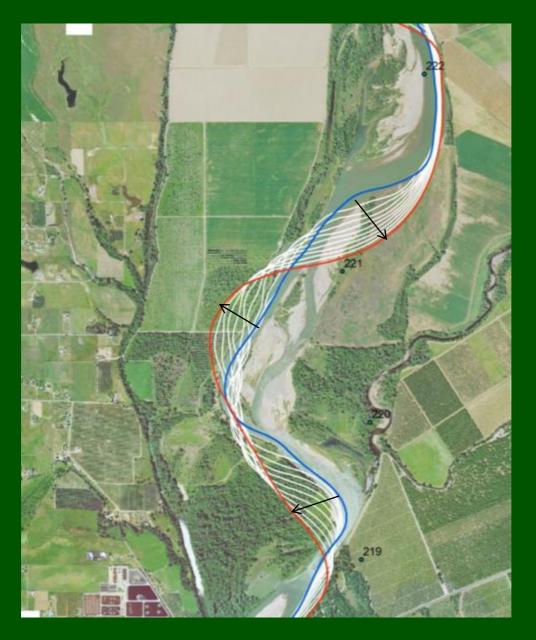


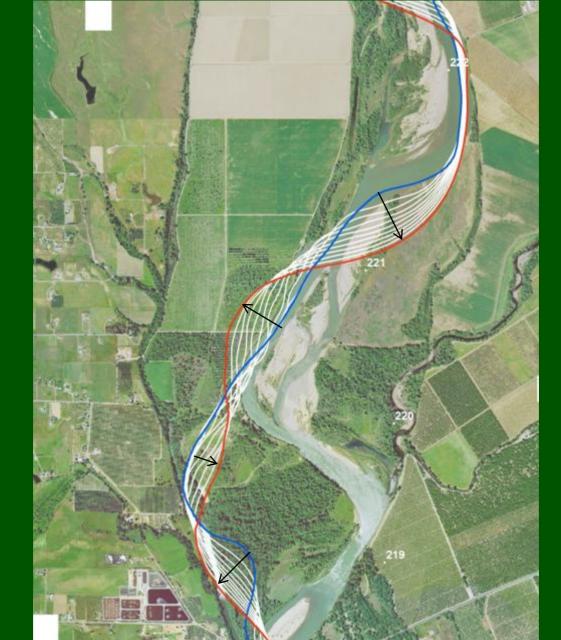


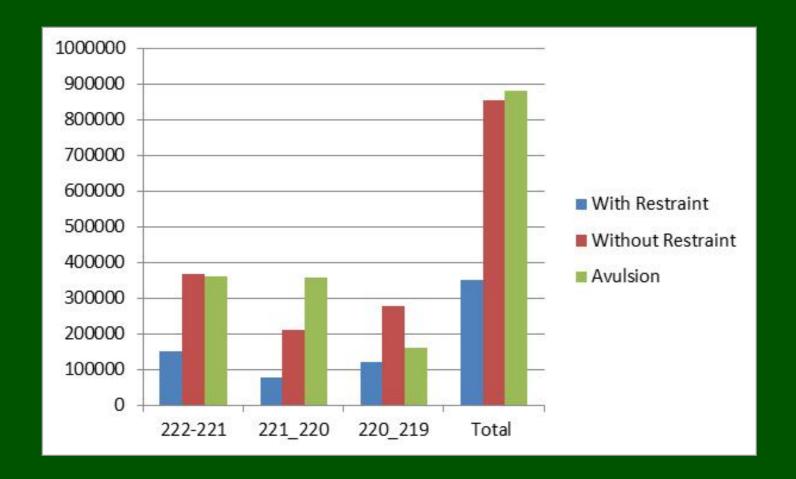
# Calculating area reworked





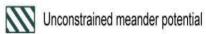






# Area reworked (m<sup>2</sup>)

Existing (constrained) meander potential



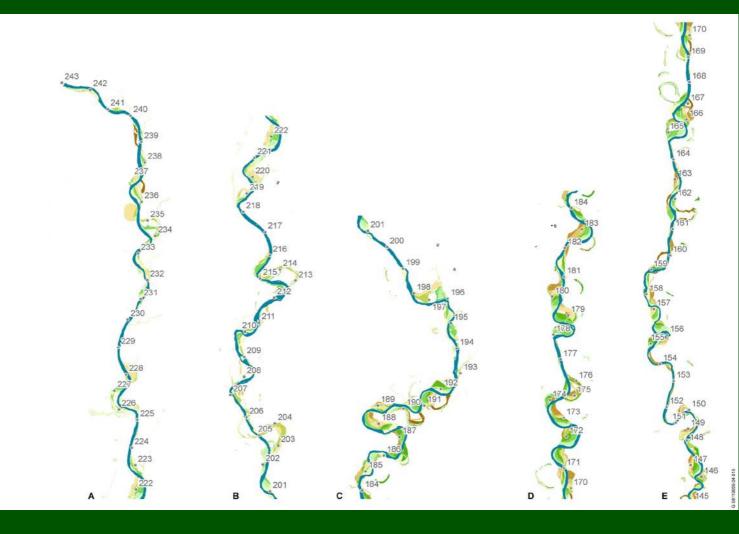




# Floodplain age Metric for riparian forest dynamics

- -extent of primary succession
- -extent of forest size

percentage of mixed age classes



# How does this help?

# Metrics – a quantitative method

- 1. define baseline conditions
- 2. assess where and when geomorphic process is potential and is (or is not) actualized
- 3. evaluating impacts/benefits of management actions
- 4. guides improvement in ecosystem function

# What's next?

## Main premise:

restoring fluvial process is fundamental to restoring habitat

choose more metrics?

- extend meander zone potential map
- analyze San Joaquin and other portions of Sacramento and tributaries with similar methods



### **THANKS**

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